METEOROLOGICAL OFFICE
16 JAN1976
C
LIBRARY

RESTRICTED CIRCULATION

THIS PAPER IS NOT AN OFFICIAL DOCUMENT; IT IS FOR INFORMATION ONLY AND MUST NOT BE QUOTED IN ANY PRINTED PUBLICATION

Agricultural Memorandum No 767

Gastro-intestinal nematode infection in sheep and cattle: a predictive technique using 24 hour rainfall data

by

J R STARR

Introduction

The epidemiology of Ostertagia infection in domestic ruminants is described in Agricultural Memorandum No 765 and an objective technique suggested for predicting the date of maximum pasture contamination by the nematode larvae, based on 12-hour rainfall records.

However the agriculturalist may not be close to a meteorological station that records twice-daily rainfall. Many more stations, E.H.F.'s and experimental sites record only daily rainfall. This memorandum, therefore, describes a method of estimating the date of peak nematode larval count from 24 hour rainfall totals.

A cumulative rainfall technique

Methods of allocating 'wet scores' to daily rainfall totals, similar to that described in Ag.Mem.765, were found to be unsatisfactory and a technique depending on cumulative totals was tried. The principle used was that a pasture, once moistened, could not get wetter and therefore, rainfall above a certain quantity per day contributed nothing more to nematode larval development. Further, by inspecting cumulative totals derived in this way, and in line with the Thomas's experimental evidence (Ag Met 765), it was evident that early rainfall required a low weighting.

It was found that a reasonable correlation with Thomas's Cockle Park peak larval count dates could be found by the following method:

1. Cumulative totals of 24-hour rainfall were found for half-monthly periods from 16 April to 30 June using the criterion that daily rainfall of more than 5mm was ascribed the value 5mm.

2. Using the same criterion five-day cumulative totals were found for the period 1 July onwards (thus maximum cumulative 5-day rainfall is 25mm).

3. Weighting factors of 0.1, 0.2, 0.3, 0.5 and 0.8 were applied to the respective periods 16-30 April, 1-15 May, 16-31 May, 1-15 June, 16-30 June. Totals for the subsequent five-day periods carried their full value.

4. The technique indicated a 'critical index' of 70 units (mm).

FH23

A 'Warning index' of 50 is illustrated in the tables, which present the comparison between Thomas's experimental peak count date and calculated values using rainfall data from Cockle Park, Acklington and Tynemouth.

Results from Cockle Park, Acklington and Tynemouth

The comparison is reasonable, although some calculated dates are close to the maximum experimental error of ±10 days suggested in Ag.Mem.765; since that Ag.Mem. presents peak count data for Acklington and Tynemouth, a direct comparison between the two techniques is possible for these stations. It should be noted that Cockle Park is the site of the experiments and its rainfall will give an indication of the representativeness of Acklington and Tynemouth rainfalls. Cockle Park should show the most accurate peak count dates and for the majority of years this appears to be the case.

Summary.

The technique produces results which are suprisingly good in view of its relative crudeness in, effectively, directly relating nematode larval development to rainfall amount. The weighting method does however, realistically model the observed 'concertina effect' (Ag.Mem.765). The main advantage, apart from simplicity in application, is that there are many 24-hour rainfall stations and an agriculturalist should be able to find a close, representative data source (and could even use his own measurements!) A further point concerns the warning afforded by the 'Warning Index'. The maximum daily allocation of rain is 5mm and so an index of, say, 50 (as tabulated) will give at least 4 rain-days warning of potential pasture contamination. The operational use would be similar to that described in Ag.Mem.675. (In the table warnings vary from 6 days to over a month).

[A note about the tables:

For each year there are three columns:

1. is rainfall total in stated period.
2. is weighted total.
3. is cumulative total from 16 April.]

Any comments or suggestions on this paper should be referred to the Author.

Meteorological Office
Bracknell

December 1975

Table 1

Peak Nematode Larval Count

Peak date inferred from cumulative, weighted rainfall totals (Rainfall ≥ 5 mm ascribed value 5)

Cockle Park

Period	Weighting Factor	1967			1968			1969			1970			1971		
16–31 April	x0.1	10.7	1		26	3		20	2		8.3	1		11.7	1	
1–15 May	x0.2	41.7	8	9	34.9	7	10	33.2	7	9	7.3	1	2	8.3	2	3
16–31 May	x0.3	34.8	10	19	5.5	2	12	26.3	8	17	0.1	0		14.1	4	7
1–15 June	x0.5	0.3	0	19	5.2	2	14	10.5	5	22	0	0		18.1	9	16
16–30 June	x0.8	19.1	17	36	23	18	32	25.2	20	42	15	12	14	25.6	21	37
1–5 July	x1	2.5		38.5	10		42	4.5		46.5	5.0		19	2.9		39.9
6–10 "		5.0		43.5	12.7		54.7	9.5		56	8.5		28.5	0		
11–15 "		9.3		52.8	13.8		68.5	0			0.2		28.7	0		
16–20 "		9.3		62.1	11.2		79.7	0			12.5		41.2	3.9		43.8
21–25 "		2.5		64.6				0.1		56.1	19.7		60.9	24.0		67.8
26–31 "		9.7		74.3				7.3		63.4	6.3		66.3	3.5		71.3
1– 5 Aug								5.7		69.1	0			14.4		
6–10 "								6.5		75.6	4		70.3			
11–15 "											8.2					
16–20 "											10					
21–25 "																
Observed date of Peak Count		26 July			16 July			5 Aug			19 Aug			2 Aug		
Calculated, based on count of 70		31 July			16 July			8 Aug			9 Aug			30 ~~Aug~~ July		
Warning based on 50		17 July			10 July			10 July			23 July			22 July		

Table 1a

Cockle Park (contd)

Period	Weighting Factor	1972			1973			1974			1975		
16–31 April	x0.1	6.6	1		22.8	2		10.3	1		23.9	2	
1–15 May	x0.2	31.3	6	7	16	3	5	15.2	3	4	25.2	5	7
16–31 May	x0.3	17	5	12	24	7	12	3.7	1	5	0.4	0	7
1–15 June	x0.5	33.2	17	29	5.0	2	14	17.9	9	14	14.7	7.3	14.3
16–30 June	x0.8	14.3	11	40	21.7	18	32	14.2	11	25	7.9	6	20.3
1–5 July		6.7		46.7	0.1		32.1	19.5		44.5	2.5		22.8
6–10 "		3.6		50.3	15.1		47.2	0.2		44.7	10		32.8
11–15 "		0.4		50.7	10.5		57.7	10		54.7	10.5		43.3
16–20 "		0.3		51	9.2		66.9	21		56.8	4.6		47.9
21–25 "		13.3		64.3	4.1		71	3.4		60.2	9.3		57.2
26–31		7.2		71.5				2.3		62.5	1.7		58.9
1–5 Aug		4.2						0.2		62.7	1.8		60.7
6–10 "								14.9		77.6	3.6		64.3
11–15 "								12.4			15.1		79.4
16–20 "													
21–25 "													

Observed Peak Count date	3 Aug	16 July	19 Aug	(4–18 Aug)
Calculated, based on count of 70	31 July	22 July	9 Aug	13 Aug
Warning based on 50	21 July	13 July	15 July	22 July

Peak Nematode Larval Count

Based on cumulative weighted rainfall. (R ≥ 5 mm is ascribed value 5)

Acklington

Period	Weighting Factor	1967			1968			1969			1970			1971		
16–31 April	x .1	9.2	1		29.5	3		24.4	2.4		12.4	1.2		15.9	1.6	
1–15 May	.2	37.8	7	8	24.8	5	8	30.8	6.2	8.6	8.7	1.7	2.9	8.4	1.7	
16–31 May	.3	32.7	10	18	5.9	2	10	25.3	7.6	16.2	2.5	1.	3.9	20.1	6.	3.3
1–15 June	.5	2.9	1.4	19.4	2.8	1.4	11.4	13.1	6.5	22.7	0.4	.2	4.1	11.	5.5	9.3
16–30 June	0.8	24.4	19	38.4	25.8	21	32.4	25.9	21	43.7	18.5	14.8	18.9	26.9	21.5	14.8
1– 5 July		1.2		39.6	9.0		41.4	4.0		47.7	2.2		21.1	2.8		36.3
6–10		5		44.6	5.4		46.8	5.7		53.4	7.7		28.8	0		39.1
11–15		12.4		57.0	12.2		59	1.1		54.5	2.5		31.3	0		
16–20		10.2		67.2	11.5		70.5	1.2		55.7	6.1		37.4	2.3		39.1
21–25		3.1		70.3				2.3		58.0	16.0		53.4	25.		41.4
26–31		2.1		72.4				10.5		68.5	11.2		64.6	5.9		66.4
1– 5 Aug								3.0		71.5	0			12.		72.3
6–10								6.3			5.6		70.2			
11–15											3.8					
16–20											10.4					
21–25																
Observed date of peak count			26 July			16 July			5 Aug			19 Aug			8 Aug	
Calculated based on count of 70			21 July			20 July			3 Aug			10 Aug			31 Aug	
Warning based on 50			14 July			12 July			8 July			25 July			21 July	
															22 July	

Table 2a

Peak Nematode Larval Count

Acklington (cont'd)

Period	Weighting Factor	1972			1973			1974			1975		
16–31 April	x0.1	6.1	.6		15.	1.5		15.1	1.5		17.5	1.8	
1–15 May	.2	26.9	5.4	6	11.3	2.3	3.8	11.6	2.3	3.8	20.9	4.2	6
16–31 May	.3	12.9	3.9	9.9	22.3	6.7	10.5	3.0	1	4.8	0	0	6
1–15 June	.5	30.8	15.4	25.3	3.6	1.8	12.3	19.1	9.5	14.3	19.7	9.9	15.9
16–30 June	x0.8	11.0	8.8	34.1	16.6	13.3	25.6	5.6	4.5	18.8	9.3	7.6	23.5
1– 5 July		8.1		42.2	0			18.1		36.9	1.0		24.5
6–10		1.5		43.7	10		35.6	0.7		37.6	4.9		29.4
11–15		0.5		44.2	17.5		53.1	11.1		48.7	9.6		39
16–20		0.1		44.3	8.0		61.1	7.5		56.2	7.7		46.7
21–25		16.7		61.	3.9		65	2.5		58.7	6.5		53.2
26–31		5.6		66.6	0.3		65.3	0.5		59.2	1.0		54.2
1– 5 Aug		9.0		75.6	8.5		74.8	0		59.2	0.1		54.3
6–10		6.2						8.7		67.9	0		54.3
11–15								10.1		78.0	10.1		64.4
16–20								5.1			10.		74.4
21–25											0.1		
Observed date of peak count				3 Aug			16 July			19 Aug			(4–18 Aug)
Calculated based on 70				1 Aug			3 Aug			12 Aug			19 Aug
Warning based on 50				23 July			15 July			16 July			23 July

Table 3

Peak Nematode Larval Count

Tynemouth

Period	Weighting Factor	1967			1968			1969			1970		
16-31 April	X0.1	13.3	1.3		29.	2.9		26.6	2.7		10.8	1.1	
1-15 May	X0.2	40.4	8.	9.3	25.1	5.0	7.9	26.9	5.4	8.1	10.4	2.1	3.2
16-31 May	X0.3	26.4	7.8	17.1	6.9	2.	9.9	17.1	5.1	13.2	3.3	1	4.2
1-15 June	X0.5	5.1	2.5	19.2	5.8	2.9	12.8	14.5	7.2	20.4	0	0	
16-30 June	X0.8	22.7	18.1	37.3	26.	20.8	33.6	22.6	18.1	38.5	18.2	14.6	18.8
1- 5 July		0.8		38.1	10.7		44.3	4.5		43.	2.5		21.3
6-10 "		5		43.1	6.9		51.2	6.8		49.8	1.2		22.5
11-15 "		5.6		48.7	11.8		63.	0			3.2		25.7
16-20 "		4.9		53.6	12.2		75.2	0.2		50	10.2		35.9
21-25 "		0.8		54.4				3.2		53	15.5		51.4
26-31 "		6.8		61.2				10.9		64.1	10.2		61.4
1- 5 Aug		4.3		65.5				3.4		67.7	0		61.4
6-10 "		5		70.5				5.8		73.5	6.2		67.6
11-15 "											1.6		69.2
16-20 "											10		79.2
21-25 "											8.6		

Observed date of Peak Count	26 July	16 July	5 Aug	19 Aug
Calculated, based on count of 70	8 Aug	17 July	10 Aug	16 Aug
Warning, based on 50	17 July	10 July	19 July	25 July

Table 3a

Tynemouth (Cont'd)

Period	Weighting Factor	1971			1972			1973			1974			1975		
16-31 April	X0.1	15.5	1.6		7.8	1		13.9	1.4		8.1	1		20.6	2	
1-15 May	.2	9.6	1.9	3.5	22.	4.4	5.4	8.3	1.6	3	8.4	1.6	2.6	30.7	6	8
16-31 May	.3	17.2	5.1	8.6	13	4	9.4	15.6	4.6	7.6	1.1	.3	2.9	0.6	-	
1-15 June	.5	6.6	3.3	11.9	25.2	12.6	22	6.0	3.0	10.6	18.	9	11.9	16.4	8.2	16.2
16-30 June	X0.8	27.7	22.	33.9	15	12	34	21.5	17.2	27.8	12.3	10	21.9	5	4	20.2
1- 5 July		0.4		34.3	7.5		41.5	0			18.1		40	0.1		20.3
6-10 "		0			0.8		42.3	9		36.8	1.0		41	10.		30.3
11-15 "		0		34.3	0			13.7		50.5	10.0		51	14.4		44.7
16-20 "		0.6		34.9	0.1		42.4	17.4		67.9	6.0		57	3.1		47.8
21-25 "		15.8		50.7	11.1		53.5	5.4		73.3	2.0		59	12.3		60.1
26-31 "		11.1		61.8	5.6		59.1				6.9		65.9	0.3		60.4
1- 5 Aug		9.9		71.7	4.6		63.7				0.6		66.5	0.1		60.5
6-10 "					10.3		74.				10.2		76.7	0		
11-15 "					0						13			10		70.5
16-20 "														10		
21-25																

Observed date of Peak Count	2 Aug	3 Aug	16 July	19 Aug	4-18 Aug
Calculated, based on Count of 70	4 Aug	8 Aug	22 July	6 Aug	15 Aug
Warning, based on 50	25 July	23 July	15 July	23 July	23 July